On the availability of inverse scope reading in Dutch doubly-quantified thetic sentences

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Abstract

This study investigates the availability of inverse scope readings in Dutch doubly quantified sentences, focusing on thetic (general rule-based) versus categorical (individual-focused) contexts. Although previous research suggests that inverse scope readings are rarely available in Dutch simple transitive sentences, we show that such readings are available and that the availability of such readings correlates with the theticity and tense of the doubly quantified sentences. Building on Mandarin experiments by Wu (2019, 2023), the study adopts a 2x2 design for Dutch, manipulating utterances' tense (present vs. past) and context (thetic vs. categorical). The results of a scope judgment task (N=113) show that inverse scope is significantly more acceptable in thetic contexts than in categorical ones, and marginally less acceptable in sentences about the past compared to the present. These results challenge the isomorphic scope interpretation typically proposed for Dutch doubly-quantified simple transitions and contradict the claim that indefinite subjects cannot be interpreted non-specifically in Dutch. Furthermore, this study provides cross-linguistic evidence for the impact of the thetic-categorical distinction on the quantifier scope and calls for further investigation into the interaction between temporal marking, thetic-categorical distinction, and scope interpretations.

1 Introduction

Unlike the ambiguity of scope observed in English (1), canonical Dutch transitive sentences with an indefinite subject and a universally quantified object (2) strongly reject the inverse scope reading (Philip 2005; Hendriks, Koops van 't Jagt, and Hoeks 2012).

(1) A bear tickles every turtle.
a. (surface scope) a > every: 'There is a specific bear who tickles all the turtles.'
b. (inverse scope) every > a: 'For every turtle, there is a different bear who tickles it.'

(Hendriks et al. 2012, ex. 1)

(2) Een beer kietelt elke schildpad.
a bear tickles every turtle;
'A bear tickles every turtle. (a > every; *every > a) (Hendriks et al. 2012, ex. 2)

However, in certain contexts, such as in (3), Dutch speakers find the doubly quantified sentence fully ambiguous, similar to its Mandarin counterpart, despite claims that both Mandarin and Dutch typically exhibit an isomorphic scope interpretation for doubly quantified simple transitives.

(3) Zoals opgelegd door de wet, bewaken drie politieagenten iedere uitgang.
as required by the law, guard three policemen every exit
'As required by law, three policemen should be guarding every exit. (3 > every, every > 3)

(Wu 2019, ex. 239)

(4) (Anzhao falü guiding) san-ming jingcha kanshou meige chukou.
(As law demands) Three-CL policemen guard every exit
'As required by law, three policemen guard every exit.' (3 > every; every > 3)

The context in (3) and (4), which allows inverse scope readings in Dutch and Mandarin, is known as a thetic environment. According to Kuroda 1972 and his subsequent work, thetic sentences assert general regularities or the existence of events. In contrast, categorical sentences attribute properties to specific

individuals. In the Japanese data that Kuroda 1972 examined, a categorical sentence in Japanese is grammatically marked through 'topic marking' and is composed of a thetic predication combined with a direction of attention, interest or consciousness toward an entity. Interestingly, it has been observed that inverse scope readings are not available in categorical sentences in Mandarin (Larson and Wu 2018) and in English (Basilico 1998; Basilico 2017). However, what exactly the relationship is between the thetic-categorical distinction and quantifier scope remains an intriguing yet understudied question.

Although very few studies have experimentally tested scope judgments in thetic sentences, Wu (2019; 2023) has confirmed the high availability of inverse scope readings in Mandarin thetic sentences (4). However, the thetic environment does not always yield a high availability of inverse scope readings, as it may be constrained by other syntactic cues. For instance, Wu and Larson (2023) observed that in thetic sentences, the accessibility of inverse scope readings appears to vary depending on the presence of the aspect marker, being more accessible when the aspect marker is absent and less accessible when it is present. Ladusaw (1994) following Kratzer (1989) and Diesing (1992), argues that temporal orientations reflected in the INFL domain can cue the thetic-categorical distinction. It also aligns with our basic language intuition that sentences with past temporal orientation (e.g., aspect marker is present) often express completed events and completed events often involve presupposing specific individuals (i.e., more compatible with categorical environments). But, it remains unclear if and how theticity and tense affect scope judgments in languages and if these patterns generalize across languages.

Questions & Hypotheses

The present study aims to experimentally investigate if and how theticity and tense affect quantifier scope readings in Dutch. Unlike Mandarin Chinese which relies on grammatical aspects to indicate temporals, Dutch obligatorily marks tense on the inflected verb, making it a great test case for disentangling the effects of theticity and temporal orientation.

Based on existing research and our native intuitions, two main hypotheses and predictions emerge. First, we hypothesize that inverse scope readings are more available under thetic contexts than under categorical contexts. We predict that this pattern holds for Dutch doubly quantified sentences irrespective of the temporal orientation markings of the sentence. Second, we expect that temporal marking affects the degree of availability of inverse scope. We anticipate that doubly quantified simple transitives with past tense in Dutch allow less for inverse scope readings compared to the ones with present tense, since descriptions of past events are more likely to be associated with specific individuals.

2 Methodology

Materials

Building on Wu's (2019; 2023) experiments with Mandarin thetic sentences, we designed a 2x2 experiment to investigate scope judgments in Dutch. We created 4 sets of stories that manipulated the TENSE and CONTEXT of the target utterances. Each target utterance contained a transitive verb with an indefinite numerical plural subject and a universally quantified singular object (e.g., *drie studenten versieren elk klaslokaal* 'three students decorated every classroom'). We manipulated the TENSE of the target utterance to be PRESENT or PAST. In addition, we provided context for the utterances that were either THETIC (descriptions of general rules or traditions) or CATEGORICAL (about specific individuals and a specific event) and matched the temporal orientation of the target utterance.

An example item set can be found in Figure 1. The situation contexts were displayed in blue, and target utterances in red. After each target utterance, participants were asked to complete a binary forced-choice task. A question was displayed (matching the tense and theticity of the context), asking the participant how many people were involved with the described action, given that there was X number of objects: 'X' or 'more than X' (e.g., *Er zijn vijf klaslokalen. Hoeveel studenten zijn er aan het versieren? Drie studenten of meer dan drie studenten?* 'There are five classrooms. How many students are decorating? Three students or more than three students?'). The choice of 'X' corresponds to surface scope reading while the choice of 'more than X' corresponds to inverse scope reading.

In addition to the target utterances, we created 12 filler items that required participants to read the context carefully and use the information provided in the context to answer questions based on quantity. For example, indicating the maximum or minimal amount a person wants to spend on a gift or indicating

the minimal or maximal time that someone is required to work. These filler items were used as attention checks to make sure participants paid attention to the instructions when completing the tasks. We also randomized the presentation order of the two given choices for filler items, in order to counterbalance potential biases that may arise from a default tendency to select the first or second option.

	Thetic present	**Thetic past**	**Categorical present**	**Categorical past**
Situation:	Volgende maand moet de tweede klas de klaslokalen voor het eerste leerjaar inrichten voor de feestdagen. De mentor van de tweede klas, die alles graag goed geregeld heeft, vraagt de directrice naar de regels en richtlijnen voor het inrichten van de lokalen, zodat alles volgens de traditie verloopt. De directrice antwoordt:	Tijdens een schoolreünie bespreekt een docent met een oud-leerling hoe de schooltradities door de jaren heen zijn veranderd. Nu is het gebruikelijk dat heel de eerste klas de versiering regelt tijdens de feestdagen, maar vroeger was het anders. De docent vraagt hoe dit in voorgaande jaren geregeld werd. De oud-leerling antwoordt:	Het is 1 april en een groepje studenten heeft bij hun school binnengebroken om een grap uit te halen waarbij ze de klaslokalen van de onderbouw helemaal volhangen met slingers en ballonnen. Door hun acties is echter het automatische alarmsysteem afgegaan, en een medewerker van het beveiligingsbedrijf heeft de conciërge opgebeld om te vragen wat er aan de hand is. De conciërge antwoordt:	Op 1 april heeft een groepje studenten bij hun school binnengebroken om de klaslokalen helemaal vol te hangen met slingers en ballonnen. De volgende dag ziet de directeur alle rommel en vraagt aan de conciërge wat er gebeurt is. De conciërge antwoordt:
	Next month, the second-year students need to decorate the first-year classrooms for the holidays. The second-year mentor, who likes to keep everything well-organized, asks the principal about the rules and guidelines for decorating the classrooms to ensure everything goes according to tradition. The principal replied:	*During a school reunion, a teacher discusses with a former student how school traditions have changed over the years. Nowadays, it's customary for the entire first-year class to handle the decorations during the holidays, but it used to be different. The teacher asks how this was organized in previous years. The former student replied:*	*It's April 1st, and a group of students broke into their school to pull a prank by filling the classrooms of the lower grades with streamers and balloons. However, their actions triggered the automatic alarm system, and a security company employee called the janitor to ask what was going on. The janitor replied:*	*On April 1st, a group of students broke into their school to fill the classrooms with streamers and balloons. The next day, the principal sees the mess and asks the janitor what happened. The janitor replied:*
Target:	Drie studenten versieren elk klaslokaal. *Three students decorate every classroom.*	Drie studenten versierden elk klaslokaal. *Three students decorated every classroom.*	Drie studenten versieren elk klaslokaal. *Three students are decorating every classroom.*	Drie studenten versierden elk klaslokaal. *Three students decorated every classroom.*
Question:	Er zijn vijf klaslokalen. Hoeveel studenten zijn er normaal gesproken nodig om ze te versieren? *There are five classrooms. How many students are usually needed to decorate them?*	Er waren vroeger vijf klaslokalen. Hoeveel studenten waren er normaal gesproken nodig om ze te versieren? *There used to be five classrooms. How many students were usually needed to decorate them?*	Er zijn vijf klaslokalen. Hoeveel studenten zijn er aan het versieren? *There are five classrooms. How many students are decorating?*	Er zijn vijf klaslokalen. Hoeveel studenten waren er aan het versieren? *There are five classrooms. How many students were decorating?*
Response:	A. 3 B. more than 3	A. 3 B. more than 3	A. 3 B. more than 3	A. 3 B. more than 3
Scope:	3 > every every > 3	3 > every every > 3	3 > every every > 3	3 > every every > 3

Figure 1: Example stimulus set (n = 4) displaying each experimental condition. Stories manipulated the context (thetic or categorical) and tense (present or past) of the target utterances. All items are available online.

Data acquisition, Pre-processing & Analysis

We recruited 145 adult Dutch-speaking participants (18 - 62 years old, M = 32.6, SD = 9.36) via Prolific 2024 for a 5 to 10-minute study conducted on Qualtrics. After completing two practice items, participants were presented with 4 target items (one per condition, drawn from four different sets) and 12 filler items in a randomized order. Participants viewed one item at a time and were not allowed to revise previous responses. To ensure coverage of all 16 target utterances, the experiment had 4 versions, each containing a different subset of the target items. We excluded 32 participants who scored below 85% accuracy on the filler items, leaving 113 participants. These participants collectively provided 19 to 23 observations per target utterance.

We calculated the response percentages of the forced choice task (choosing 'X' or 'more than X') for each condition, aggregated across items to visualize the data. To determine whether participants' responses were influenced by our experimental manipulations, we analyzed the binary response data with a generalized linear mixed-effects model. Our maximal converging model included CONTEXT (thetic or categorical) and TENSE (present or past) and their interaction as fixed effects, with random intercepts for items and participants. To test the contribution of our fixed effects, we performed a likelihood ratio test comparing our model and a nested model leaving out the variable of interest. The analysis was performed using the glmer-function from the 'lme4' package in R (Bates et al. 2015; Team 2021). We used the 'emmeans' package (Russell 2022) to generate predicted probabilities and standard errors so that we could visualize the model's findings while accounting for variation across participants and items.

3 Results

The nested GLMM model comparisons revealed that CONTEXT was a significant predictor of participants' responses to the forced choice task ($\chi^2(1) = 6.76, p < .01$). The odds of selecting 'more than X' (inverse scope) increased for utterances in a thetic context compared to a categorical one (OR = 1.99, CI = 1.17–3.38). The utterance's TENSE was not a significant predictor ($\chi^2(1) = 3.29, p = .07$), although the odds of selecting 'more than X' marginally increased for present compared to past utterances (OR = 1.58, CI = 0.96–2.61). The predicted probabilities of choosing 'more than X' in the different experimental conditions are displayed in Figure 2. There was no significant interaction between the two predictors ($\chi^2(1) = 0.19, p = 0.66$).

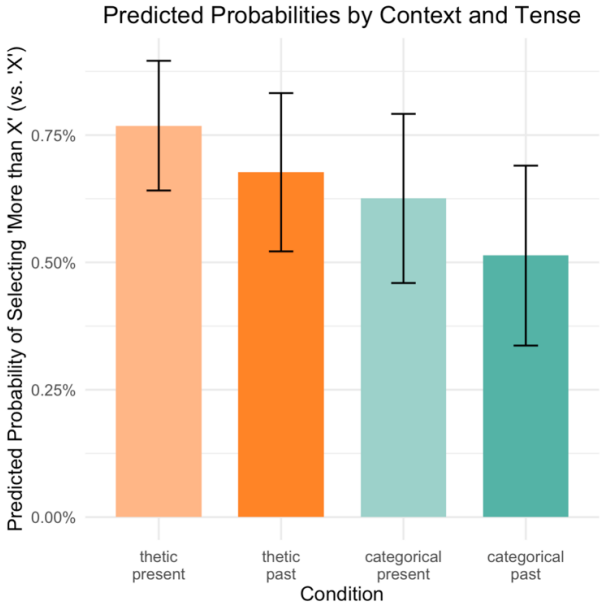

Figure 2: Predicted probability of selecting 'more than X' (inverse scope) over 'X' (surface scope) for experimental conditions, based on GLMM model output.

Predicted probabilities of choosing 'more than X' were higher than anticipated, ranging from 50% (categorical past) to 75% (thetic present). Two factors contributed to this. First, among our 113 participants, 23 participants always picked 'more than X' and 8 only picked 'X', which may indicate a response bias or misunderstanding of the task instructions. For the 82 remaining participants who did differentiate between conditions, we plotted their average responses in Figure 3, aggregated by experimental condition and item set (1–4).

As can be observed from the grouped responses to different experimental item sets, a second contributing factor to the high proportion of predicted 'more than X' responses is the fact that half of the experimental items elicited a high proportion of 'more than X' responses in general. Observationally, high-stakes items (e.g., police officers guarding exits) elicited more 'more than X' responses compared to casual situations (e.g., children decorating classrooms).

4 Discussion

All in all, our experimental design was effective in showing that thetic contexts increase the availability of inverse scope judgments in Dutch, just as previously observed for Mandarin Chinese (Wu 2019; Wu 2023). We also found that tense independently affects sentence interpretation, such that inverse scope is less available in past tense sentences, even though this effect was only marginally significant. Besides the effects of our experimental manipulations, we also observed high variability between participants and experimental items. The majority of participants (n = 82) distinguished between experimental conditions, while 23 consistently chose responses aligned with an inverse scope reading and 8 exclusively favored surface scope interpretations. Future research should explore whether these patterns reflect genuine population-level differences in scope assignment or can be attributed to task-specific effects. In

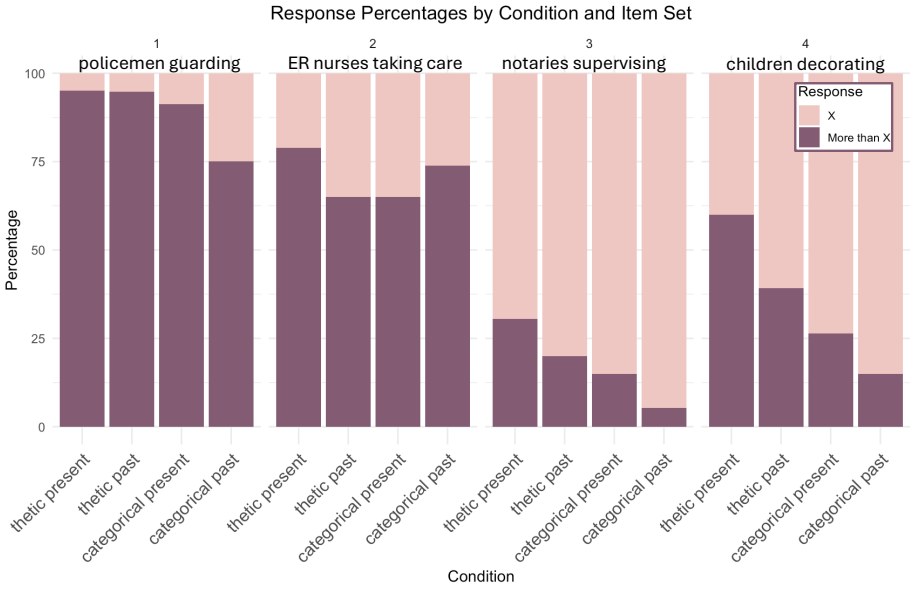

Figure 3: Percentage of average responses per condition and item set (1-4) across the 83 participants that differentiated between experimental conditions.

addition to this, high-stake scenario items (e.g., nurses manning intensive care units) elicited a much higher proportion of 'more than X' responses (compatible with an inverse scope reading) than items describing more casual situations (such as children decorating classrooms). We believe this might be imposed by world knowledge, e.g., the knowledge that it is more likely and more necessary to have many nurses in the intensive care unit. The exact influence of world knowledge on scope judgments should be explored further.

An important avenue for further research is the role of temporal markings in the accessibility of inverse scope. While the current study found only a marginal effect of tense, a pilot study (n = 12) indicated that the perfective aspect (e.g., *Drie kinderen hebben elk klaslokaal versierd* 'Three children have decorated every classroom') almost exclusively biases interpretations toward surface scope. This finding aligns with our native speaker judgments and suggests that the bounded timeframe associated with the present perfect may encourage a categorical perspective. In subsequent studies, we aim to manipulate tense and aspect in Dutch and Mandarin to compare the scope effects of temporal markings across these languages.

5 Theoretical Implications

The results yield several theoretical implications. First, the availability of the inverse scope reading in thetic contexts provides evidence against the isomorphic scope interpretation (i.e., surface scope only) typically argued for Dutch doubly-quantified simple transitives, and questions the accounts that have been proposed or employed to explain the absence of inverse scope reading in Dutch simple transitives (Beghelli and Stowell 1997, Philip 2005, Hoop and Krämer 2005, Hendriks, Koops van 't Jagt, and Hoeks 2012). The syntactic account (Beghelli and Stowell 1997) attributes the issue to covert movement, arguing that inverse scope reading is only possible when the subject is reconstructed to a scope position lower than Spec of DistP where the universal quantified object needs to land, but this covert movement is not accessible to sentences like (2). However, this account fails to explain why covert movement is accessible to sentences like (3) to yield inverse scope reading but not accessible in (2) in Dutch. In contrast, the pragmatic account (Philip 2005) argues that the interpretation of indefinite subjects in Dutch transitive sentences with a sentence-initial subject and a universally quantified direct object is guided by a pragmatic rule favoring the strongest meaning consistent with contexts. Take (2) as an example, the surface scope reading implies the inverse scope reading but not vice versa: if a specific bear tickles every turtle, then it is also true that each turtle is tickled by some bear, but not the other way around. Therefore, Dutch speakers would always choose the surface scope reading according to the Strongest Meaning Hypothesis. This account fails to explain why Dutch speakers would not obey the pragmatic rule and choose inverse

scope readings for sentences like (3). Likewise, Hoop and Krämer 2005's semantic constraint account also fails to account for the high availability of inverse scope readings in Dutch thetic sentences since this constraint argues that subjects should receive a specific interpretation and object receive a non-specific interpretation, making the inverse scope reading impossible. Moreover, none of these accounts fully explains the considerable variation among adult native speakers of Dutch as observed in the experiment, nor what conditions contribute to these differences.

Second, the availability of inverse scope readings contradicts the general claim that indefinite subjects cannot be interpreted non-specifically in Dutch (Hoop and Krämer 2005, Hendriks, Koops van 't Jagt, and Hoeks 2012). Instead, the results support the theoretical conjecture of Philip (2005: 274) that "it is always in principle possible for a high indefinite subject to be nonspecific as long as the verb is transitive.". An overlooked observation in the literature is that Dutch adults accepted the inverse scope reading for sentences like (2) about 20% of the time in a sentence-picture matching task (Hendriks, Koops van 't Jagt, and Hoeks 2012). However, the previous accounts did not answer the question of under what conditions can the indefinite subject be nonspecific reading, and a doubly-quantified sentence can have inverse scope reading (Wu and Larson 2023). Instead, the thetic-categorical framework by Kuroda 1972 offers a clear explanation of when an indefinite subject can have a nonspecific reading. In thetic contexts, the identity of the indefinite subject is irrelevant to the goal of describing the regularities, allowing for a nonspecific reading and, thus, the possibility of scope permutation with the universal quantifier.

Third, the significantly higher acceptability of inverse scope readings in thetic contexts compared to categorical contexts, especially in present inflected sentences in Dutch, provides important cross-linguistic evidence for the influence of the thetic-categorical distinction as well as tense marking on quantifier scope. Wu and Larson 2023 argues that the thetic-categorical distinction is encoded in the topic-prominence property of Mandarin. In Mandarin, subjects are by default categorical subjects and simple transitive sentences are typically categorical sentences. However, subjects in Mandarin can become thetic subjects in a de-topicalized structure to express a thetic sentence, thus allowing for scope permutations with quantified objects. Dutch, while not a prototypical topic-prominence language, shares similarities to Mandarin in that speakers strongly prefer interpreting grammatical subjects as definite but readily allow nonspecific readings for thetic readings. It is thus worthwhile to explore the interaction between temporal marking and the thetic-categorical distinction, as well as their combined influences on scope interpretations from a cross-linguistics perspective.

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Data Availability: All stimuli, data, and analysis files are available at: `https://osf.io/ztxcu/`.

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